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Submit to the journal of food control**Topic: Implementation of food safety management systems in the UK**

Abstract: This paper reports the first stage of work being undertaken to understand the factors that have impacted on the current state of food safety in the UK food manufacturing sector. The paper first explores developments in international food safety regulation in general and in particular, the UK. Using a survey and case study methodology, the paper examines the response of food manufacturing enterprises to food safety regulation, and uses statistical techniques to investigate the effects of enterprise size on the drivers for, benefits of, and challenges to compliance. Further, the factors that influence the successful implementation of an integrated food safety management system are also examined. The results show a great deal of both statutory and private regulation that has incentivised enterprises. In response, enterprises have implemented integrated food safety management systems to proactively deal with the risks associated with food safety, however, enterprises claim that statutory regulations are biased towards consumers, without adequate impact assessments on all stakeholders within the chain, and hence causing industry to incur significant costs that could otherwise be avoided. Even though compliance with food safety regulation is burdensome, the cost of non-compliance will also be significant to enterprises. The findings also show that there is no significant effect of size of enterprise on the drivers, benefits and challenges to compliance with food safety regulation.

Key words: Regulation, food safety, Implementation Factors, Food and Drinks Manufacturing Sector, UK

Paper classification: Research paper

1. Introduction

The competitive landscape for international trade in food is continuously evolving. Most developed and developing countries are removing tariffs and quotas as trade barriers, and implementing more stringent measures to ensure the safety of food. Food safety is the concept that food will not be injurious to the consumer at the point of consumption, when it is prepared and/or eaten according to its intended use (BS EN ISO 22000, 2005). Regulators of the food sector have justifiable reasons for these changes in competitive landscape. Some have attributed it to the increased awareness of consumers about food safety, which is causing them to put pressure on regulators. Others have attributed it to the outbreak of *Salmonella* and *Bovine Spongiform Encephalopathy* (BSE) in the UK (Loader and Hobbs, 1999) and *E. Coli* 0157:H7 in some developed countries in Europe and America. Developing countries have also had their fair share of food contamination issues, even though the scale of impact is difficult to estimate, due to inadequate surveillance systems and reporting structures (WHO/FAO, 2005). These occurrences in the past awakened concerns of major stakeholders; they believed that prevailing mechanisms of controls and management of food safety were inefficient and ineffective (Henson and Jaffee, 2006). The economically more advanced nations have been the driving force for most of these changes (Hanak et al., 2000), with their governments striving consistently to increase traceability and transparency through integrated approaches to food safety management. As a result of these developments, there has been a general reform of existing frameworks for the governance of food safety globally. These forms of control executed at the global level, however, have implications at the domestic level, in terms of what practices can be undertaken at the different functional nodes of the global food value chain. Governments have incorporated the reforms at the global level into their national reforms, through various forms of

incentives which put additional responsibility on enterprises, and in the case of small and medium enterprises (SMEs), more pressure on their already scarce resources, making survival uncertain. Mandating the implementation of integrated food safety management systems has been seen by many as one of the most certain ways of assuring food safety, given the nature of food, the difficulty associated with determining its safety before consumption and the potentially devastating effects of food safety failure on human life. However, for some of the stakeholders who bear direct responsibility for operationalising the requirements of integrated food safety regulation, the process requirements are onerous, and yet the expected benefits that drive compliance are not actually realised upon implementation. Further, the process is fraught with a lot of both internal and external challenges. A number of literature exist on the impact of food safety regulation on enterprises, the drivers for, benefits of, and challenges to an integrated approach to operationalising the requirements of food safety regulation in a variety of countries and sectors; these studies have provided guidance on how to effectively implement regulatory requirements on the shop floor, particularly in Hazard Analysis Critical Control Point (HACCP) regulation, and the compliance process model. Even though SMEs are said to contribute significantly to the economies of most countries, they are the least likely to comply with regulatory requirements because of resource constraints. Most studies have focused on large enterprise, independent of SMEs, arguing that it is difficult to get responses from smaller enterprise, and hence there is a paucity of work in this area. Further, the authors are not as yet aware of any study that has particularly studied the drivers, benefits, challenges and success factors in the context of the UK food manufacturing sector. Exceptions occur in Fairman and Yapp, (2004) and Yapp and Fairman, (2006), who studied some of the variables in the context of SMEs in the catering sector and Taylor, (2001) who did not make explicit the sector of focus. The uniqueness of this paper lies in the use of an empirical approach to study food manufacturing enterprises in the UK, a statistical examination of the significance of the difference between both SMEs and large enterprises in relation to an integrated approach to food safety management, and a contribution to the insights relevant to challenges enterprises face, to inform future policy revisions and decisions. Section 2 looks at the developments in food safety regulations and section 3 discusses public and private regulation of food safety in the UK. Section 4 outlines the methodology, and results are presented in section 5. A discussion of results is done in section 6 and conclusion made in section 7.

2. Developments in food safety regulation

The governance of food safety has evolved significantly in the past two decades. The evolution has affected the way in which food safety is assured globally. Notable trends include:

A move towards more stringent approaches to food safety

Food safety control presently combines both performance-based approaches (e.g. end-product testing, inspection and sample testing) and integrated process-based approaches (e.g. regular audits, assessment by third party auditors, accreditation) to food safety management. Voluntary inspections have almost given way to mandatory legal frameworks in the form of Acts and Directives. Retailers are now using recognised certification frameworks (hands-off), which set out the basic minimum requirements of food safety acceptable in the global food industry, and require supplying enterprises to be certified by

third party auditors, before qualifying to supply food. Such certifications may be voluntarily or mandatorily sought by suppliers.

A requirement to justify food safety regulations

Through the World Trade Organisation (WTO), trade barriers related to tariffs and quotas have been lowered considerably. This has fostered growing interdependencies through the exchange of food products, across national borders. However, emphasis is being placed on non-tariff barriers, and the wider recognition of their impact on trade (Henson and Caswell, 1999). The established view among some researchers is that, standards in developed countries present trade barriers to less developed countries (Henson and Jaffee, 2006). Therefore, the Sanitary and Phytosanitary Agreement (SPS) was formulated by the WTO, to ensure that no country is unduly restricted from participating in global value chains. The SPS agreement endorses the use of international standards, based on CAC's recommendations as a control measure for food safety, and requests that importing countries with regulatory standards more stringent than international standards, justify both scientifically, through risk-based assessments (SPS Agreement, Article 5, paragraph 1), and/or economically (SPS Agreement, Article 5, paragraph 6), through systematic quantified assessment of the costs and benefits of proposed food safety regulations (Henson, and Caswell, 1999).

A proliferation of standards

There has also been an increase in the number of standards that seek to promote food safety. These include the British Retail Consortium's global food safety standard (BRC), the International Food Standard (IFS), the Dutch Hazard Analysis and Critical Control Point (HACCP), the Safe Quality Food (SQF) 2000 Level 2, and the ISO 22000:2005 .

- The BRC standard was developed in 1998, to respond to the needs of UK retailers and brand manufacturers, however, the standard has gained popularity globally (e.g. in Europe and North America).
- The IFS on the other hand was drawn up by the German and French retailer and wholesaler associations, and their Italian counterparts. IFS aims to create a consistent evaluation system for all enterprises supplying retailer branded food products.
- The SQF Program is owned by the Food Marketing Institute (FMI). The standard combines both food safety and quality management certification for all chain participants involved in the production and processing of food.
- The Dutch HACCP was designed by the Dutch National Board of Experts, to specify the requirements for HACCP-based food safety systems. The standard specifies the codes of practice within a management system framework, and is particularly suitable for suppliers to the Dutch market.

ISO 22000 is a global standard developed to harmonise on a global level, the requirements for food safety management, for businesses in food businesses (BS EN ISO 22000 2005), apart from food manufacturers.). The standard combines interactive communication, system requirements, prerequisite programmes, and HACCP principles to assure food safety. The ISO 22000:2005 is complemented with the PAS 220 Prerequisite Programmes (PRPs) on food safety for food manufacturing to form the new Food Safety System Certification (FSSC) 22000 for food manufacturers.

Similarities and differences amongst standards

Most of the standards discussed above are similar in the sense that they all have one main objective: to protect consumer health through an integrated process-based food safety management, achieved through specifying the basic minimum requirements acceptable for food safety, and third party audits. They provide a framework for uniformity in requirements, audit procedures and mutual acceptance of audits, and reassure retailers and branded manufacturers of the capability and competence of suppliers,

[Take in Table 1]

All the standards have the Codex Alimentarius Commission's (CAC) HACCP principles as their foundation and some integrate quality management system requirements (table 1) into the food safety standards (e.g. BRC, IFS, SQF). The major difference amongst the standards is that they are owned by different stakeholders in different geographical regions, and while some seek to specify generic requirements that could be adapted to chain participants at different functional nodes in value chains, some are specific to either primary food producers or food processors.

Attempts at harmonising food safety regulations

There are significant variations in food safety regulations across countries and among value chains. These variations increase the burden of auditing costs and certifications on food manufacturers, as retailers require different certification frameworks to qualify suppliers. The impacts of these variations on relevant actors present practical reasons for the need for harmonising food safety regulations (Motarjemi et al., 2001). There are, however, justifiable reasons to explain these variations (Henson and Jaffee, 2006). Some are attributed to the distinct tastes, diets, income levels and perceptions that influence the tolerance of populations, towards the risk associated with food. The different private standards introduced by brand manufacturers and retailers further introduce more variations into food safety regulations and the modes of conformity assessments (Henson and Mitullah, 2004). A common reference point was therefore required, from where the process of harmonisation of standards could be started, to reduce multiple certifications on food enterprises. The SPS Agreement, introduced by the WTO, facilitates a move towards this much needed common reference point, by providing a basis to establish equivalence and harmony in food safety regulations. According to Article 4, paragraph 1 of the SPS Agreement, Member States are to accept the measures of control employed by others as equivalent if the exporting country demonstrates to the importing country that its' measure meets the importing country's appropriate level of health protection. As mentioned in earlier sections, harmony is further encouraged by the WTO, through the endorsement of international standards as a measure of control for food safety. The WTO Agreement on Technical Barriers to Trade (TBT) which is binding on Member States, also includes as principles to foster harmonisation, the 'one-one-one' principle, which implies, one standard, one test accepted everywhere, one conformity assessment mark where relevant (IEC, 2008).

In light of discussions above, international standards clearly form a fundamental part of food safety harmonisation. The proliferation of global food safety standards necessitated a system to ensure that a global standard developed for one region and retailer was valid for other regions and retailers. It is as a result of these issues that the Global Food Safety Initiative (GFSI) was introduced in 2000, to benchmark existing certification frameworks for food safety, to ensure convergence amongst food safety standards, and to maintain a benchmarking process for food safety management schemes. So far, thirteen GFSI

benchmarked international standards for manufacturing, primary production and one for both primary and manufacturing have been accepted by major retailers (e.g. Carrefour, Tesco, Metro, Migros, Ahold, Wal-Mart and Delhaize) (CIES, 2007). The international standards recognised by the GFSI have successfully been aligned with the common criteria defined by food safety experts from the Food Business. This implies those retailers will accept any of the recognised GFSI certification schemes as proof of 'due diligence' in food safety procedures (CIES, 2007).

Tougher requirements for laboratory analysis and third party auditing bodies

The changing landscape of food safety has put increased pressure on laboratories used for analysing products for food safety and third party auditing bodies. There has been a trend toward '*accreditation*' of laboratories and third party auditing bodies – a process by which conformity assessment bodies are examined for independence, competence and skill, among other things (IEC 2008). The 'accreditors', who usually receive their authority from government, use this process to assure confidence and mutual recognition of accreditations in the food value chains.

An increased role and responsibility for consumers

An effective and efficient control and management of food safety requires the concerted efforts of industry, government regulators, academia and consumers. Previously, a lot of emphasis was placed on what governments had to do to assure food safety. Recent developments recognise the role of consumers (Hanak et al., 2000) and the private sector as essential. The consumer's role in food safety is threefold: handling and using food in the appropriate manner, being at the receiving end of potential health risks in value chains, and playing an advocacy and watchdog role in the regulatory process. Through the third role, consumers provide information to regulators on food safety. Consumer representation on decision making and policy is particularly significant in the UK. There are specialist consumer organisations which focus exclusively on both general consumer and sectoral interest, which may be formed by government, with specific statutory status (Simmonds, 2002); and others are established by non-governmental organisations. Consumer bodies are involved in meetings of national or international technical committees, during the standards development process, to ensure that the regulations developed conform to standards that address issues of concern to consumers.

3. Public and private regulation of food safety in the UK

The control and management of food safety in the UK has been realised through partnerships of both the public and private sector (fig. 1). Major stakeholders include national government, non-governmental sector bodies, special interest groups and value chain actors. Food safety assurance is achieved through two main routes: private regulation and statutory regulation of the food industry. Statutory regulation controlling food is primarily to protect the health of consumers and prevent fraud (Tansey and Worsley, 1995). These goals are achieved by a combination of the Food Safety Act 1990 as amended (similar versions available for Scotland, Northern Ireland and Wales), which is the primary regulation for food safety, and secondary regulations and Directives, issued by the European Union.

[Take in Figure (No.1)]

The Act, regulations and Directives are used to constrain the behaviour of actors in the food value chain, and implement policies that serve consumer interests. These statutory regulations also spell out behaviours, mechanisms for enforcing them, and sanctions to be

applied. According to the Food Safety Act 1990, retailers have an obligation to exercise 'due diligence' to assure food safety. This 'due diligence' defence protects consumers, and shields traders from being convicted, in the event of crisis, if they have taken all reasonable precaution and exercised all due diligence to avoid committing the offence.

Private regulation of food safety is linked to the trend of major retailer development of own-brand range of food products (Lawrence et al., 2002). To ensure that suppliers of retailers are not exposed to product liability, a system was required to ensure 'due diligence' in safety procedures. This was necessary so that in the event of criminal or civil prosecution against the retailer, there will be proof that 'due diligence' has either been followed or not. Retailers developed in-house food technology departments in the 1980s to monitor their own-brand food supply lines and visited their suppliers, giving technical advice. In the 1990s, retailers advised suppliers to use third party auditors, approved by them to audit their safety systems. As a result of concerns raised about the variations characterising the different requirements and the approaches to third party auditing, consensus was reached by British retailers, on a common minimum standard for food safety. This was to provide third party auditors with a common basis with which to provide 'due diligence' defence for retailers. Coming along these developments was the introduction of the BRC standard in 1998, to specify the basic minimum requirement for food safety. Presently, other standards are being adopted for use by British retailers, which also specify the minimum basic requirements for food safety acceptable by relevant stakeholder, at the different functional nodes in value chains.

Drivers for, benefits of and challenges to compliance with food safety regulations

Compliance with food safety regulation has become a ticket for accessing the global food value chain. The past few decades have seen significant new developments (section two above) that have tightened controls in different countries. In response, the interest of most researchers in this research community has shifted to understanding the evolving competitive landscape as a result of these new developments, and examining the response of enterprises to food safety regulation from different geographical positions, to improve policy decisions that will benefit both small and medium enterprises (SMES) and larger enterprises. The environmental and quality literature is fairly grounded in terms of the role of regulation in assuring environmental sustainability (see Rugman and Verbeke, 1998a & b) and product quality, the drivers, benefits and challenges to compliance, and the food safety literature is increasingly drawing on these two perspectives to inform explanations to the response of enterprises to food safety regulation, and how it affects enterprises. However, Loader and Hobbs, (1999) suggest that enterprise response to food safety regulation may be different to other forms of regulation because of the sensitive nature of food safety issues and the immense perceived importance of them. In spite of this, in all three types of regulations (environmental, quality and food safety), enterprises are expected to take action in order to protect the environment, public health and safety. The wealth of literature available gives insights into the behaviour of enterprises, which suggest that the response of enterprises is not automatic; it reflects the interplay among different types of incentives operating at the level of mandated government regulation, pressure from the markets and liability laws (Jayasinghe-Mudalige and Henson, 2007; Khatri, and Collins, 2007; Henson and Hooker, 2001). Whether enterprises respond in a positive or negative manner depends on a variety of factors e.g. sector, enterprise size, financial situation and level of risk adversity (see table 2). Further, the impact of these incentives on the enterprise is dependent on their

perception of costs and benefits of compliance or non-compliance. From existing studies, it is apparent that regulation is a very important incentive for compliance in most countries and the degree of enforcements could cause even the smallest of enterprises to comply without question.

[Take in Table 2]

Successful implementation factors

A variety of studies have studied the impact of implementing an integrated food safety management system in countries e.g. Canada (Jayasinghe-Mudalige and Henson, 2007), Italy (Romano et al., 2004) and Australia (Khatri, and Collins, 2007), in different sectors e.g. catering, meat and poultry processing, without necessarily examining what ensures successful implementation. This is indicative of the fact that there is paucity of research on relevant factors to consider for successful implementation. A myriad of papers have focused particularly on how to implement the HACCP component of international standards without considering relevant factors to the whole system implementation. Trienekens and Zuurbier (2008), however, draw on the quality literature to suggest that adequate information should be available for planning, execution, and monitoring functions. In addition to this management support is also essential for successful implementation. As a result, this paper draws on empirical evidence to investigate the underlying constructs to influence successful implementation of integrated FSMs.

4. Methodology

A survey methodology was complemented with case studies because the structure of the questionnaire did not allow for a detailed investigation into compliance of enterprises, even though it allowed for the use of a sample to estimate population characteristics (Wright, 1997). The findings of the survey were inadequate in themselves to provide detailed explanations of the responses given and hence case study method was used to make up for this limitation (Yin, 2009).

The study was interested in the institutional arrangements that have impacted on the current state of food safety and the response of food manufacturers to food safety regulation in the UK Food and Drinks manufacturing sector. The study used certification to food safety standards as a measure of compliance and as a shift from the dependence on performance-based approaches to integrated approach to food safety management.

Data collection

A review of relevant literature was conducted on developments in food safety control and management in general and particularly, in the UK. A postal survey-based questionnaire was then designed and administered from May-August, 2009. Postal surveys were employed because the details for target respondents were not readily available, however, general enterprise details were hosted by various databases, and hence it was easier executing this phase of the study using this technique. A section was included in the survey-questionnaire to collect details of enterprises which were willing to participate further. By including this section, which was optional for respondent, the direct contact details of quality managers was collected to allow for a detailed further investigation using interviews. Three enterprises agreed to take part and hence their quality and technical managers were interviewed to gain insights and underlying reasons for their responses.

Research instrument

A structured survey-based questionnaire was developed, drawing on existing literature that studied the drivers for, benefits of, and challenges to, compliance with food safety regulation in other countries, and the requirements of the ISO 22000 international food safety standard. The purpose of the research instrument was to explore the impacts of an integrated food safety management system on enterprises, and investigate empirically, best practices associated with implementation. The questionnaire was divided into three main sections:

- the first section dealt with the background of the enterprise in relation to food safety management systems (food safety standards certified to¹, motivation² for compliance, benefits² of compliance, and challenges² to compliance with food safety regulation). An open ended question was included in this section to request for information on the mode of dealing with the topmost challenge.
- The section also asked respondents to rate a range of factors in relation to their contribution to successful design, implementation and continuous improvement of food safety management systems, indicate their mode for developing food safety management systems and equipping personnel with food safety competences.
- The second section explored food safety management system design, implementation and continuous improvements (management responsibility, resources management, planning and realisation of safe products); however, the results of this section are not presented here, because they are being used to form the basis for further detailed investigations. The third section concerned the characteristics of the company: ownership structure, factory size in terms of number of employees and respondent details. The survey-based questionnaire was reviewed by three researchers in other disciplines of study and piloted with a specialist in the field of food safety management.

A semi-structured interview script was used to gain further insights into responses given in the survey. The questions were standardised to increase interviewer consistency (Fowler, 2002).

Sample for survey

The target population was food manufacturing enterprises, which was drawn from FAME, courtesy Cranfield University Library Resource. FAME is a database that contains information of enterprises (e.g. trading addresses, phone numbers, and websites) in the UK and Ireland. The target population contains both animal feed producers and human food manufacturers. Within this target population, the sample frame of interest is the human food manufacturers. Out of the 3.4 million enterprises hosted by the database, search criteria were used to narrow down to relevant enterprises in the sample frame. The criteria comprised: type of industry, industry location and status. The search string used was the UK Standard Industrial Classification of Economic Activity, SIC (2003), all Category 15, which represents “manufacture of food products and beverages”. A total of 6553 enterprises fitting these criteria were exported to Excel. The filtering tool in Excel was used to eliminate manufacturers of animal feed, dormant enterprises, and enterprises that did not specify the

¹ Respondents could select more than one option.

² Respondents were to select topmost five.

description of their products. A total of 3124 enterprises fitting the set criteria remained. This data was manually cleaned to remove duplications, retailers, distributors and enterprises providing financial services to food enterprises. Stratified sampling was used to select participant, aiming to ensure that the final sample was a good representation of the different sub-categories (e.g. dairy-based product manufacturers, manufacturers of fruits and vegetables, bakeries, poultry processors) within the sample frame. A final random sample of 500 food manufacturing enterprises fitting the criteria set out was selected for mailing. The decision to use 500 stemmed from resource constraints. A total of 37 (7.4%) mailed questionnaires were returned unopened, because enterprises had either moved addresses or were no longer in operation. The total number of responses received was 120, representing approximately 26% of the final sample (463).

Case Studies

The three cases used for further investigation were arrived at on the basis of who was willing to participate, and were drawn from the sample that was used for the survey. All three enterprises were SMEs, certified to the BRC standard and privately owned. The enterprises serviced international markets in addition to the UK market and have been in business for at least 20 years. One was an intermediary food processor and two were manufacturers of ready to eat food products.

Analysis

The responses received were manually entered into a workbook in Microsoft Excel and prepared for analysis. The prepared data was then imported into SPSS 17.0. The descriptive characteristics of the data were computed for various responses and interpreted based on emerging trends from the analysis. The data of categorical nature were analysed using the Chi-square statistical technique to identify differences in the groups of respondents (SMEs and large enterprises). Alpha (α) was set to 0.05 (Wright, 1997). Cramer's V was used to investigate the strength of the effects of size of enterprise on the drivers, benefits and challenges to compliance.

Factor analysis was conducted on the variables that influence the success of FSMS implementation, to identify underlying constructs that are most important. Cronbach's alpha was used to assess the internal consistency reliability for the overall scale of measurement and for individual elements within the scale.

Responses to the open-ended question were clustered to identify emerging themes. The responses received from the interviews were transcribed and descriptively analysed (Miles and Humberman, 1994). Conclusions were then drawn based on the outcome of the findings and analysis.

5. Results

This section presents the results of the empirical survey of the UK Food and Drinks sector.

Profile of respondents

The European Commission's definition of enterprises, in terms of number of employees (European Commission, 2003) was adopted. Approximately 54% of enterprises that responded to the survey belonged to the SME category (table.3) and 46% were large enterprises. Privately owned enterprises made up the largest of the responses (table .4).

[Take in Table 3]

[Take in Table 4]

Response to Food Safety Regulation

Majority (97.5%) of enterprises that responded to the survey had an integrated food safety management system (FSMS) in place. Three enterprises (2.5%) did not have any FSMS in place; nonetheless, these enterprises had one of the ISO 9000 series implemented. The first enterprise was a subsidiary of a multinational enterprise, manufacturing beverages, had been in business for many decades and hence had an established market. The last two enterprises were corporations, manufacturing malt for brewers. 87% of enterprises had a third party certified FSMS implemented. The BRC global food safety standard turned out to be the most popular amongst the different standards implemented by UK food enterprises (fig. 2). Approximately 78% of enterprises had the BRC's global food safety standard in place. Approximately 6% of enterprises had two food safety standards implemented. 11% of enterprises had their own version of food safety management system in place. Even though ISO 22000 has been introduced for approximately five years now, the standard and the IFS were less popular with UK enterprises. Seven enterprises were certified to the ISO 22000 standard and three enterprises were certified to the IFS.

[Take in Figure (No.2)]

Motivations for compliance

Approximately 81% of enterprises claimed that they were driven by the prospects of product safety improvement, 76% were driven by customer requirements and 60% were driven by regulatory requirements. The survey also revealed that 59% of enterprises were driven by the expected marketing advantage that could be derived from implementing the standard, others, 54% saw the potential for improved corporate image and 38% claimed that their certification was motivated by the fact that their competitors were certified. Only 35% of enterprises complied because of potential liability claim. 30% were driven by the prospect of operational cost reductions. Approximately 18% of the enterprises claimed that they complied to avoid potential export barriers from overseas customers, and because it was an insurance requirement (see fig. 3).

[Take in Figure (No.3)]

Benefits of compliance

This study also investigated the perceived benefits of complying with food safety requirements in the UK Food and Drinks sector. The findings are represented in fig. 4. From the chart, 85% of the respondents enjoyed the benefit of increased customer satisfaction. 83% of respondents claimed improved internal procedures and 82% of the respondents also claimed improvements in product quality.

[Take in Figure (No.4)]

Approximately 72% also claimed that implementing a food safety management system facilitated compliance with regulatory requirements. Less than 30% of enterprises claimed benefits relating to market access, reduced operating cost and lower insurance charges. Only one enterprise claimed no benefits were received from complying with food safety requirements.

Developer of food safety management system

Developing, implementing and continually improving food safety management systems require the effort of all employees in an enterprise to be effective and efficient. The various stages of the process require particularly relevant competencies. Enterprises have three options to adopt when developing and implementing a FSMS:

- developing the system in-house;
- inviting a consultant to develop the system, while providing him with the necessary resources;
- or jointly developing the system, while making use of both in-house personnel and a consultant.

According to the survey, most enterprises (77%) developed their systems in-house, 21% respondents claimed their system was jointly developed with a consultant, and 2% respondent handed over the whole process to a consultant. From these findings, a higher need exists for employees involved in the development and implementation of a FSMS to be technically competent as most enterprises are tending to develop their food safety management systems in-house.

Challenges to compliance

The challenges hindering compliance of enterprises to FSMSs are three-fold (fig. 5): financial, infrastructural and people related. The study identified five topmost challenges as: lack of technical knowledge and skill of employees (58%), employee resistance to change (58%), lack of awareness of the requirement (40%), high cost of development and implementation (26%), inappropriate infrastructural capabilities for validating and verifying FSMS 30%.

[Take in Figure (No.5)]

Mode of overcoming topmost challenge

In response to the open question of how enterprises overcome their topmost challenge s hindering compliance with food safety regulation, 40 enterprises (63%) out of the 64 that responded said they implemented interventions that increased the knowledge and competence of their workforce, by increasing their training budget, implementing internal training and knowledge sharing schemes, and implementing a training department (See fig. 6). 10% of enterprises said they implemented interventions that altered the existing culture within their enterprises. Approximately 8% of respondents said they improved communication in relation to awareness of food safety requirements and how it affects each employee's job description. The remaining percentage (42%) was accounted for by other respondents who suggested that they invested in equipment and software packages for the management of food safety, implemented standard operating procedures and documented their plan of action to increase the consistency of procedures, which will have a direct impact on food safety in the enterprise.

[Take in Figure (No.6)]

Successful implementation factors

The variables underlying the factors that influenced successful implementation of FSMS were ranked using a five point Likert scale, where 1, represented 'unimportant' and 5, represented 'very important'. The overall reliability of the scale of measurement was 0.835, and that for individual elements ranged between 0.81 and 0.83, which is sufficiently high (Nunnally, 1978). The Kaiser-Meyer-Olkin (KMO) statistic was 0.833, which indicates that factor analysis is appropriate and hence should yield distinct and reliable factors (Field,

2005). The correlation matrix yielded item-total correlations from 0.101 and 0.649. Since none of the correlation coefficients were 0 or particularly high, all variables were included in the principle component analysis (PCA). The results are shown in table 5). The PCA shows that the first four components explained approximately 64% of the total variance and had Eigen values of more than 1, and hence were selected for further analysis (Field, 2005). The varimax rotation suggested an optimum, interpretable four-factor solution, suppressing factors with values < 0.5 . This loading show that there are four factors and variables load very highly onto one factor, factor 4 (table 6).

6. Analysis and discussion

The study reveals a great deal of regulatory interventions by government and the private sector, which were enacted to increase transparency, traceability, consumer confidence in food safety, and protect consumer health and safety. The statutory regulatory approach was particularly deemed necessary because of the nature of food, it being a post- experience good (Weimer, and Vining, 1992) and the inability of consumers to determine its safety before purchase or consumption due to information asymmetry. Regulators, therefore, saw the need to step in to protect consumers. By so doing, it was hoped that the potential devastating effects of food safety failures could be avoided. These efforts have seen an increased responsibility of major stakeholders in the food value chain (The Strategy Unit, 2008). Enterprises have responded to stringent regulations by complying with international food safety standards, through process-based, integrated food safety management approaches and getting audited by third party auditing institutions, while still using performance-based approaches to verify specific levels of certain food safety hazards.

Motivation for, and benefits of compliance

The push for regulation on an integrated food safety management approach is primarily on the basis of the perceived degree of assurance it gives, towards the protection of public health, and the increased transparency it introduces into food value chains. How enterprises respond is, however, dependent on their strategic orientation, the nature of drivers, and the perceived industrial and economic benefits. For enterprises that are domestic oriented, compliance would normally be to domestic regulation only, however, in the UK, domestic regulation has been aligned with regional and international regulation, and the means of demonstrating compliance to UK customers requires that food manufacturers get certified to an international food safety standard. It is evident from the study that regulation is a significant driver for enterprises complying, even though product safety improvements turned out top of the list of drivers. This is reflected in the opinions of food manufacturers on the role both statutory and private regulation has played in enhancing food safety in the UK. Some manufacturers believe that the current status of food safety could still have been realised, even without statutory regulation. According to these enterprises, regulations, especially statutory regulations are unnecessary, bureaucratic, and add no more value to assuring food safety. Because of the dynamic nature of the food industry, regulations make it difficult to rapidly respond to these changes. Furthermore, the regulations are biased towards the consumer, without due assessments of the costs it imposes on industry. On the other hand, other manufacturers believe that because of the significant work and costs involved in complying with food safety regulations, most enterprises would not have complied to their current degree if there were no stringent external incentives. There is a consensus, however, on the benefits derived from compliance. This is reflected in the

benefits enterprises gained, as compliance with food safety regulation put them in good standing with both immediate customers and the statutory regulations that govern both national and global value chains. Enterprises claimed improvements in operating procedures, which is reflected in their responsiveness to internal food safety issues; a friendlier, trust worthy culture has been created and transparency is increasingly being fostered, through the use of multifunctional teams. Comparing the factors that motivated SMEs to factors that motivated large enterprises revealed two top factors common to both groups (product safety improvements, customer requirement). The Chi-square analysis revealed that there is no statistical significant effect of size of enterprise on the drivers of compliance in the UK. Similar results were identified for the benefits of compliance. However, one benefit item proved to be statistically significant, improved product safety. This means that, one can say with certainty that size of enterprises has an effect on the benefit 'improved product safety'. Since Chi-square did not indicate the strength of this effect, Cramer's V (Morgan et al, 2007) was used to estimate the strength. The value was 0.206, which was quite weak. This implies that there is at least an observed difference, which is statistically significant; however it may not be of any practical importance.

Challenges to compliance

The topmost challenge enterprises faced in their quest to implement integrated food safety management systems was people related. This is partly attributed to the low level of education and training of employees related to food safety management systems. This challenge is logical as most enterprises (73%) developed and implemented their food safety management systems in-house, making use of their own employees. As the generic knowledge and competence for manufacturing is inadequate in itself to develop and implement FSMS, a competency gap is created. This gap, if ignored could create resistant culture; morales would drop and implementation would be sabotaged. This is reflected in the number of enterprises who said employee resistance to change was one of their topmost challenges. In addition to the regular short training courses to increase knowledge of workforce on food safety, additional knowledge is required for professionals that maintain and continually improve the system in the disciplines of food microbiology and food chemistry. However, SMEs cannot afford the services of such professionals with the skills to develop, implement and maintain an integrated FSMS.

The financial related challenges arose from the costs involved in developing, implementing and continually maintaining a food safety management system. Some of these costs arise from the regular refresher training for all staff members and occasional specialised training for specific quality staff. Other costs arise from the regular audits at planned intervals, to determine whether a food safety system conforms to planned arrangements and is effectively implemented and updated regularly.

According to enterprises, the most unnecessary of these costs are those arising from the customers who turn up aside scheduled visits, as enterprises have to pay huge sums per each day of visit.

A major challenge came from getting the right infrastructural capacity to plan and implement the processes needed for validating control measures, and verifying the effectiveness of the system developed. Consequently, external agencies are contracted for validation and verifications. Here again, SMEs suffer the most because they are not able to enjoy the economies of scale provided by bulk rates from outsourced laboratory testing services (Loader and Hobbs, 1999). These findings are consistent with the work of Yapp and

Fairman (2006), Fairman and Yapp, (2004) and Taylor, (2001) and are valid both in the case of large and small enterprises. However, they are particularly true for SMEs because of their limited access to information, knowledge and competency to interpret regulatory documents. As a result, enterprises with limited resources face significant challenges. The survey found out that the challenges faced by larger enterprises are not so different from the challenges to compliance faced by SMEs, however, the limited capability and resources of SMEs makes compliance a heavy burden. However, since compliance to food safety regulation is increasingly becoming mandatory in global value chains, and sustaining food safety in the value chain is dependent on these SMEs (who are the weakest links), it is essential that efforts be made to facilitate compliance of SMEs to food safety regulation. Government could step in to provide financial related incentives to SMEs in particular. Public institutions could be set up that provide services related to validation and verification of food safety systems at costs that are affordable. Enterprises agree that the training offered by Environmental Health Officers are more affordable, however, they are biased towards microbiology, which is sometimes not beneficial for all, and hence, an improved, more targeted training, specific to sub-sectors would be more appropriate. For enterprises that decide to develop and implement the system in-house, management must ensure that employees involved in the process have the requisite competences and skill sets, to enhance morale, which will in turn increase the chances of success of implementation. Testing the null hypothesis between SMEs and large enterprises revealed that even though in practice there seems to be a difference between these two groups, the responses indicate that there is no statistical significance difference between the challenges faced by SMEs and large enterprises in the UK.

Successful implementation factors

The factor structure suggested by factor analysis indicates that the first success factor has 4 items ($n = 4$) and that relates to the involvement and recognition of relevant stakeholders. The second factor also has four items ($N = 4$) and that relates to continually upgrading systems and people, and standardising procedures. The third factor has two items ($n = 2$) which relate to equipping employees with the competences to manage food safety both within the internal and external value chain. The final factor is top management commitment. The fourth factor was the most highly loaded and in theory, represents the first hurdle to overcome before actual development and implementation begins. For some enterprises, it is management that pushes for food safety certifications or compliance. Under this particular circumstance, the first hurdle of getting top-level management involved would have been overcome. However, for other advocates, other than top management, it is essential to gain the commitment of top management, as the requirements for most international food safety standards explicitly state the requirements for management (BS EN ISO 22000, 2005). Therefore, ignoring the role of top management would be condemning the whole process to failure.

7.0 Conclusions

Food safety has become a sensitive and global issue; from recent developments in the global food industry, there is no way around it without suffering the consequences of non-compliance, regardless of whether both industrial or economic benefits are realised by enterprises or not. Even in the face of significant challenges to enterprises and the reservations of some enterprises about the regulatory process and the role of regulation in

ensuring food safety, statutory regulation enhances compliance of enterprises with food safety requirements.

Consumer safety is paramount when it comes to food safety regulation; however, regulators need to conduct due assessments of food safety risks on consumers, and the cost implications of enforcement strategies on industry, to mitigate costs incurred by industry, without compromising consumer safety.

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Tables

Table 1: Key Common requirement for food safety standards

FSMS Elements	BRC	HACCP	ISO 22000	SQF	Dutch HACCP	IFS
Management System	✓	✓	✓	✓	✓	✓
Pre-requisite Programmes	✓	✓	✓	✓	✓	✓
HACCP	✓	✓	✓	✓	✓	✓
Validation & Verification	✓	✓	✓	✓	✓	✓
Emergency preparedness/crisis management	✓		✓			
Quality Management	✓			✓	✓	✓

Table 2: Key drivers, benefits, and challenges to FSMS implementation

Variable	Themes	Authors	Country	Sector
Drivers	Legislative requirement, insurance requirement, customer requirement, employee requirement, prospect of enhanced corporate image, procedural and operational efficiency, good practice	Loader and Hobbs, 1999, Henson and Hooker, 2001, Romana et al, 2004, Khatri and Collins, 2007, Jayasinghe and Henson, 2007	Italy, Canada, Australia, USA, New Zealand	Meat and dairy sector, meat and poultry processing, meat
Benefits	Enhanced access to markets, cost effectiveness, time savings, production efficiency, employee development, improved information and communication, enhanced compliance with regulation organisational development, improved product quality and safety	Taylor, 2001, Romana et al., 2004, Trienekens and Zurbier, 2007	Europe, African Caribbean and Pacific,	Primary producers, processors and distributors
Challenges	Excessive cost of implementation, organisational culture, excessive documentation , lack of technical skills and knowledge relevant to food safety regulation, development and implementation, lack of time , difficulty in vetting suppliers	Taylor, 2001, Fairman and Yapp, 2004, Yapp and Fairman, 2004, Jayasinghe and Henson, 2007, Khatri and Collins, 2007	Australia, Europe,	Meat sector , catering sector

Table 3: Size of enterprises

Criterion	Micro	Small	Medium	Large
No. of employees (X)	X<10	10<X<50	50<X<250	X>250
Total no. of responses	0	9	52	53
% of respondents	0	7.9	45.6	46.5

*6 enterprises did not indicate their enterprise size

Table 4: Ownership structure of enterprises

Ownership structure	Total no. of responses	% of respondents
Private (Individually owned)	58	48
Subsidiary of a multinational enterprise	30	25
Corporation	19	16
Public-private partnership	8	8
Cooperatives	4	3
Publicly owned	1	1

Table 5: Successful food safety management system implementation factors

Table 5: Principal component analysis

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.341	36.176	36.176	4.341	36.176	36.176	2.619	21.829	21.829
2	1.283	10.694	46.87	1.283	10.694	46.87	2.173	18.11	39.939
3	1.087	9.062	55.932	1.087	9.062	55.932	1.713	14.274	54.213
4	1.007	8.395	64.327	1.007	8.395	64.327	1.214	10.114	64.327

Table 2: Rotated Component Matrix

	Components			
	1	2	3	4
Government intervention	.782			
Employee reward and recognition systems	.764			
External linkages with learning centers	.722			
Employee satisfaction measurement	.641	.547		
All employees awareness of the importance of food safety to the organisation		.814		
Use of standard operating procedures		.662		
Continual improvement		.571		
Employee involvement				
Education and training			.816	
Supplier management			.649	
Culture within the organisation				
Top management commitment				.827

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Figures

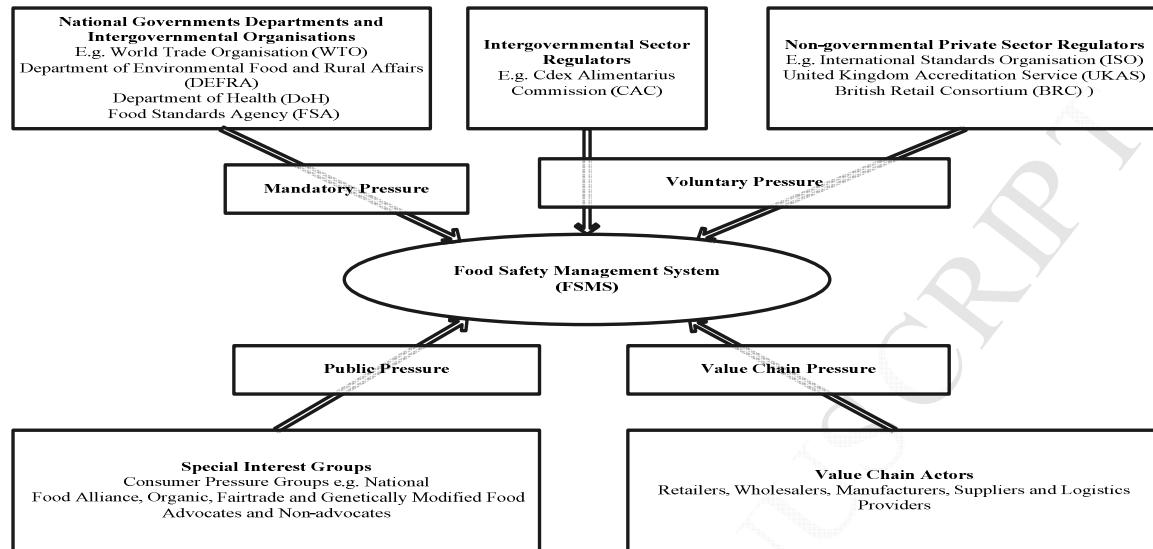


Figure 1: Major stakeholders in the UK food safety management system

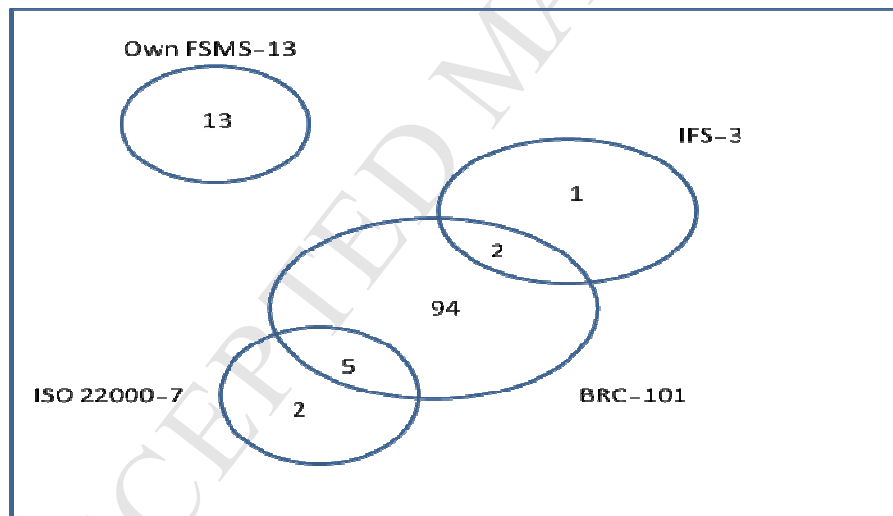


Fig. 2: Certification of FSMS

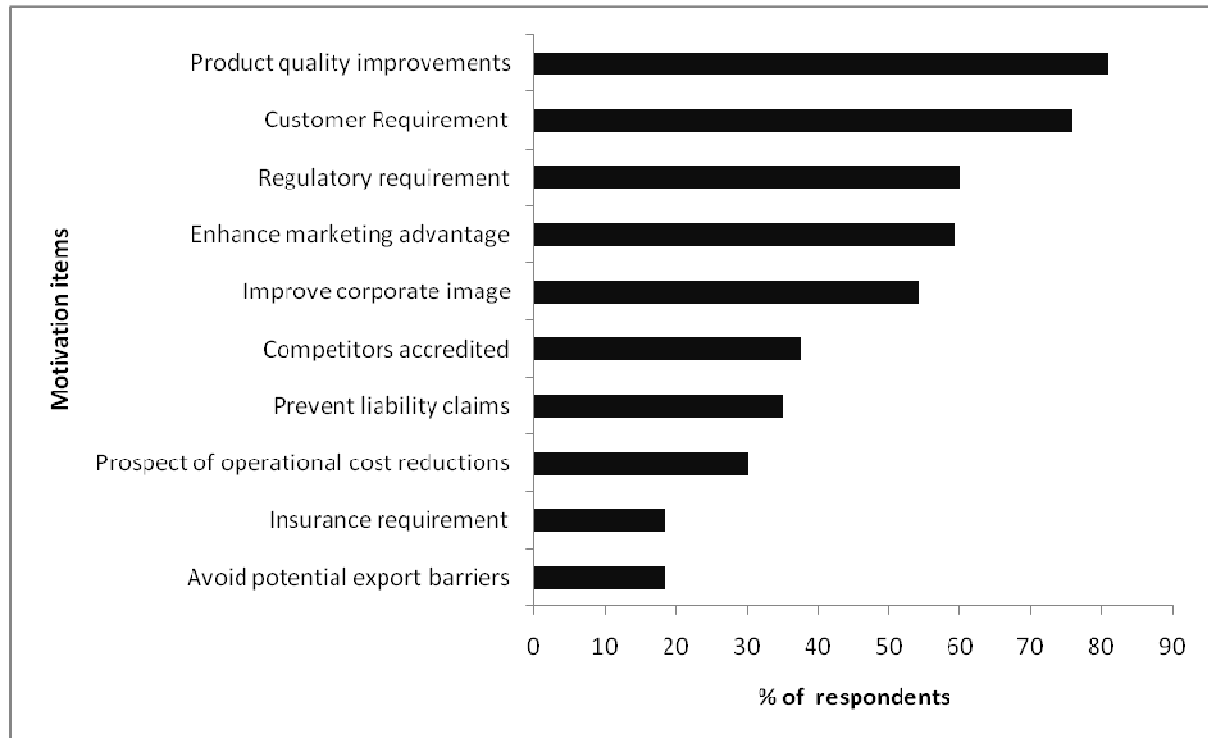


Figure 3: Motivation for compliance

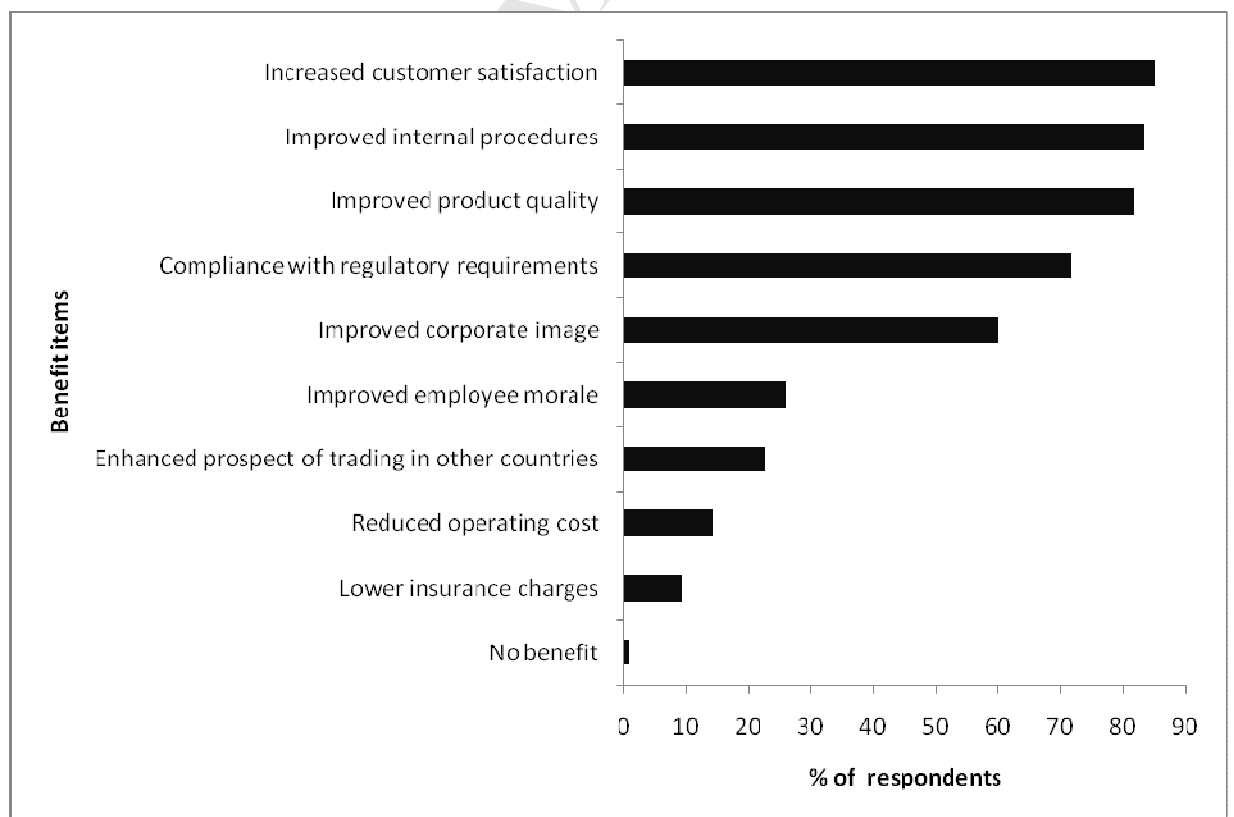


Figure 4: Benefits of compliance

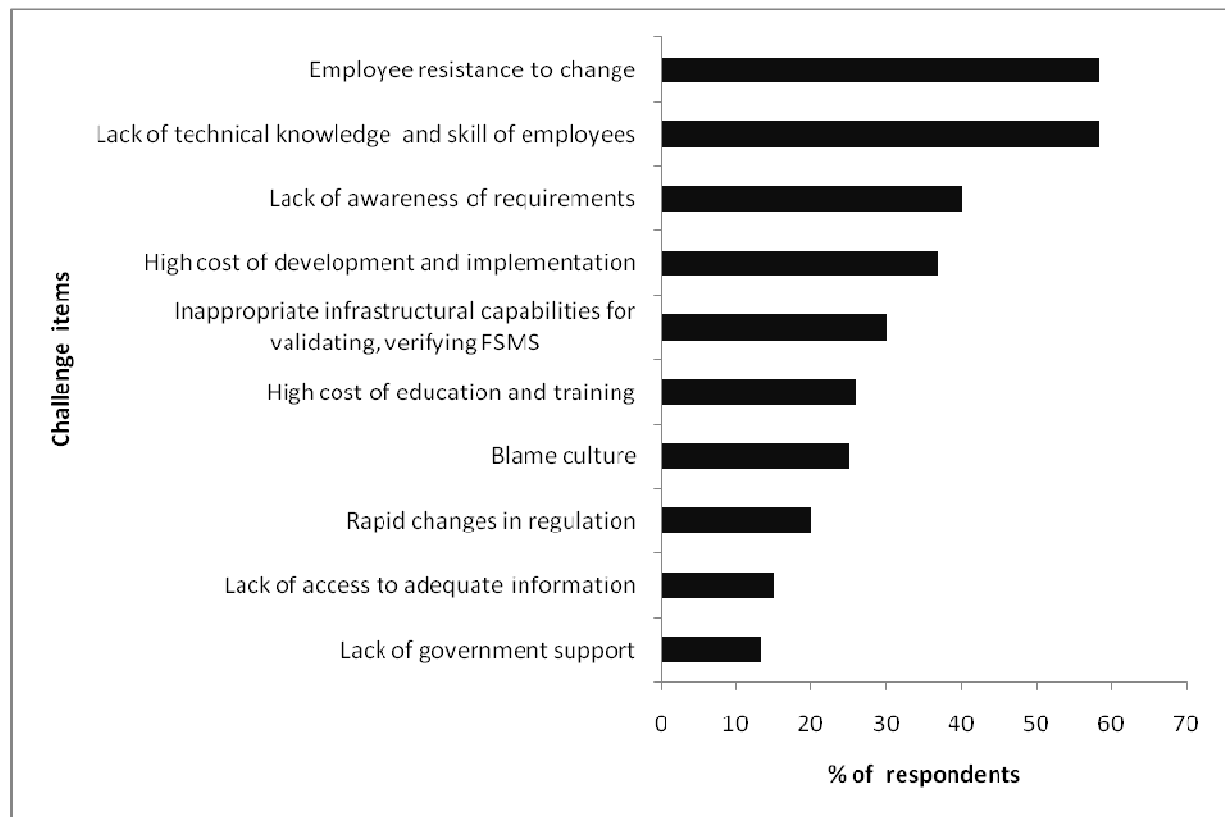


Figure 5: Challenges to food safety management system implementation

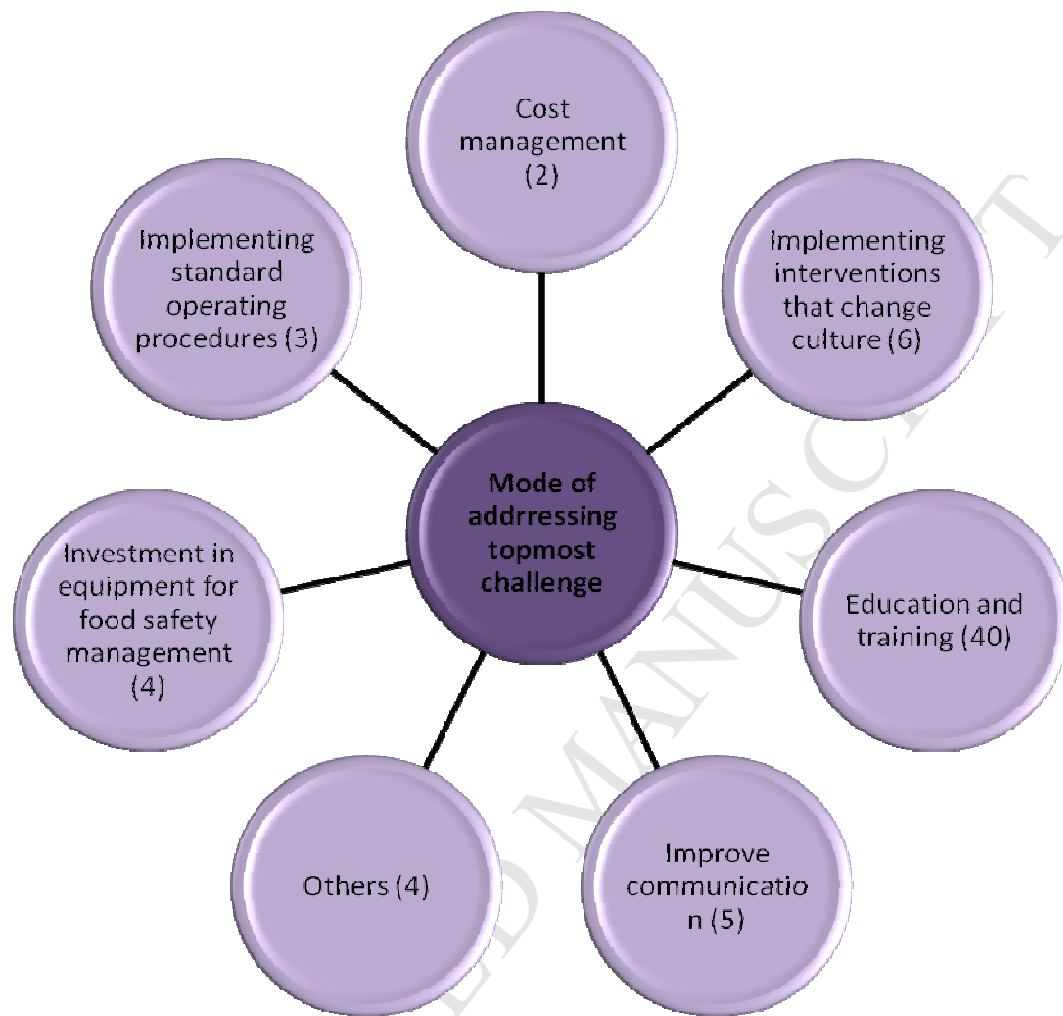


Figure 6: Intervention for addressing topmost challenge